



UNITED STATES  
DEPARTMENT OF TRANSPORTATION

# Low Emissions Zones

## Concept of Operations

Applications for the Environment: Real-Time Information Synthesis (AERIS)

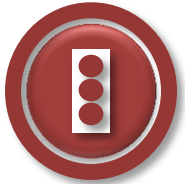
*Adapted from the Low Emissions Zones Concept of Operations Document*



AERIS

# AERIS Operational Scenarios

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## ECO-SIGNAL OPERATIONS

Uses connected vehicle technologies to decrease fuel consumption and decrease GHG and criteria air pollutant emissions by reducing idling, the number of stops, unnecessary accelerations and decelerations as well as improving traffic flow at signalized intersections.



## ECO-LANES

Dedicated freeway lanes – similar to HOV lanes – optimized for the environment that encourage use from vehicles operating in eco-friendly ways. The lanes may support variable speed limits, eco-cooperative adaptive cruise control (ECACC) and vehicle platooning applications, and wireless inductive/resonance charging infrastructure embedded in the roadway.



## LOW EMISSIONS ZONES

Geographically defined areas that seek to incentivize “green transportation choices” or restrict specific categories of high-polluting vehicles from entering the zone to improve the air quality within the geographic area. Geo-fencing the boundaries allows the possibility for these areas to be responsive to real-time traffic and environmental conditions.



## ECO-TRAVELER INFORMATION

Applications that enable development of new, advanced traveler information applications through integrated, multisource, multimodal data. An open data/open source approach is intended to spur innovation and environmental traveler information applications. Eco-Traveler Information applications include applications that assist users with finding charging stations for alternative fuel vehicles, parking applications, and eco-routing applications.



## ECO-INTEGRATED CORRIDOR MANAGEMENT

Considers partnering among operators of various surface transportation agencies to treat travel corridors as an integrated asset, coordinating their operations simultaneously with a focus on decreasing fuel consumption and emissions.





# Low Emissions Zones

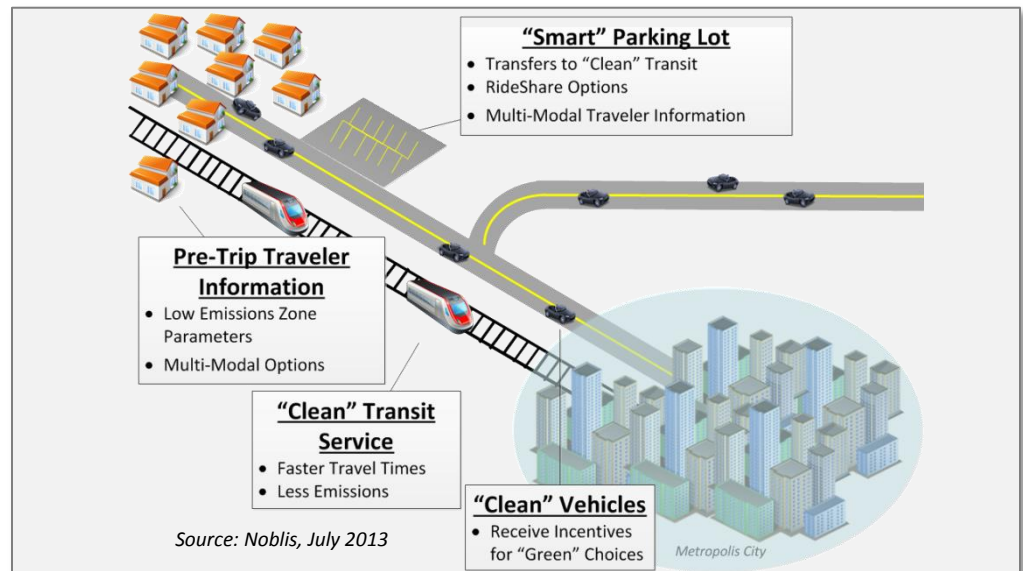
## Operational Scenario Description

- Geographically defined areas that seek to incentivize “green transportation choices” or restrict specific categories of high-polluting vehicles from entering the zone to improve the air quality within the geographic area.
- Incentives may be based on the vehicle’s engine emissions standard or emissions data collected directly from the vehicle using V2I communications.
- Geo-fencing the boundaries of the Low Emissions Zone allows the possibility for these areas to be responsive to specific traffic and environmental conditions (e.g., pop-up for a Code Red Air Quality Day, special event, etc.).

## Potential Benefits

- The London Low Emissions Zone “aims to reduce traffic pollution by deterring the most polluting diesel-engine lorries, buses, coaches, minibuses, and large vans from driving within the city.”
- According to a 2006 study, concentrations of small particles from traffic sources were expected to decrease across London by 4.3 percent in 2008 and 8.0 percent in 2010 due to the Low Emissions Zone, and  $\text{NO}_x$  was expected to decrease by 3.2 percent in 2008 and 4.1 percent in 2010.<sup>1</sup>

## Operational Scenario Visualization



# Low Emissions Zones Applications

## Application Description

### Low Emissions Zone Management

This application supports the operation of a low emissions zone that is responsive to real-time traffic and environmental conditions. The application uses data collected from vehicles using connected vehicle technologies and from roadside equipment as input to the system. The Low Emissions Zone Management application supports the geo-fencing of a cordon that may be scalable and moveable (e.g., created for a day, removable, flexible in its boundaries) and would be less dependent on conventional ITS infrastructure. The application would establish parameters including the types of vehicles permitted to enter the zone, exemptions for transit vehicles, emissions criteria for entering the zone, fees or incentives for vehicles based on emissions data collected from the vehicle, and geographic boundaries for the low emissions zone. The application would also include electronic toll collection functions that support payments of fees or collection of incentives for registered vehicles.

### Connected Eco-Driving

This application provides customized real-time driving advice to drivers so that they can adjust their driving behavior to save fuel and reduce emissions. This advice includes recommended driving speeds, optimal acceleration, and optimal decelerations profiles based on prevailing traffic conditions and interactions with nearby vehicles. The application also provides feedback to drivers on their driving behavior to encourage them to drive in a more environmentally efficient manner. Finally, the application may also consider vehicle-assisted strategies where the vehicle automatically implements the eco-driving strategy (i.e., change gears, switch power sources, or use start-stop capabilities to turn off the vehicle's engine while it sits in congestion).

### Eco-Traveler Information Applications

Applications included in the Eco-Traveler Information Operational Scenario apply. Eco-Traveler Information Applications provide pre-trip and en-route traveler information about the Low Emissions Zone. This includes information about the geographic boundaries of the low emissions zone, criteria for vehicles to enter the Low Emissions Zone, expected fees and incentives for their trip, and current and predicted traffic and environmental conditions within and adjacent to the zone. Traveler information messages may be provided to various personal devices and in-vehicle systems and used by travelers to adjust their departure time or select an alternate route. Another key component of these applications is providing travelers with transit options to encourage mode shift as well as parking information in the Low Emissions Zone or at parking lots outside of the zone.

# Goals and Objectives

Goal #1: Reduce Environmental Impacts	Goal #2: Support “Green Transportation Decisions” by Travelers and Operating Entities	Goal #3: Enhance Mobility of the Transportation System ( <i>secondary goal</i> )
<ul style="list-style-type: none"> <li>• <b>Reduce Emissions from Surface Transportation Vehicles</b> <ul style="list-style-type: none"> <li>• Reduce CO<sub>2</sub>, CO, NO<sub>x</sub>, SO<sub>2</sub>, PM<sub>10</sub>, PM<sub>2.5</sub>, VOCs</li> </ul> </li> <li>• <b>Reduce Energy Consumption Associated with Surface Transportation Vehicles</b> <ul style="list-style-type: none"> <li>• Reduce excess fuel</li> <li>• Reduce energy consumption</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• <b>Increase Modal Shifts to Transit, Walking, Bicycling, Carpooling, and Vanpooling</b> <ul style="list-style-type: none"> <li>• Increase non-SOV mode share</li> <li>• Increase transit mode share</li> <li>• Increase active (bicycle/pedestrian) mode share</li> <li>• Increase the number of carpools and vanpools</li> </ul> </li> <li>• <b>Increase Usage of Alternative Fuel Vehicles (AFVs)</b> <ul style="list-style-type: none"> <li>• Increase usage of personal, transit, and freight AFVs</li> </ul> </li> <li>• <b>Increase Eco-Driving Awareness and Practice</b> <ul style="list-style-type: none"> <li>• Increase the number of drivers practicing eco-driving strategies</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• <b>Improve the Efficiency of the Transportation System</b> <ul style="list-style-type: none"> <li>• Reduce the number of person hours (or vehicle hours) of delay</li> </ul> </li> <li>• <b>Improve Transit Operating Efficiency</b> <ul style="list-style-type: none"> <li>• Improve average transit travel time compared to auto in major corridors</li> <li>• Maintain or reduce a travel time differential between transit and auto during peak periods</li> </ul> </li> <li>• <b>Improve the Efficiency of Freight Operating Efficiency</b> <ul style="list-style-type: none"> <li>• Decrease hours of delay on selected freight-significant routes</li> <li>• Decrease point-to-point travel times on selected freight-significant routes</li> <li>• Increase ratings for customer satisfaction with freight mobility in the region among shippers, receivers, and carriers</li> </ul> </li> </ul>



# Concept of Operations (ConOps)

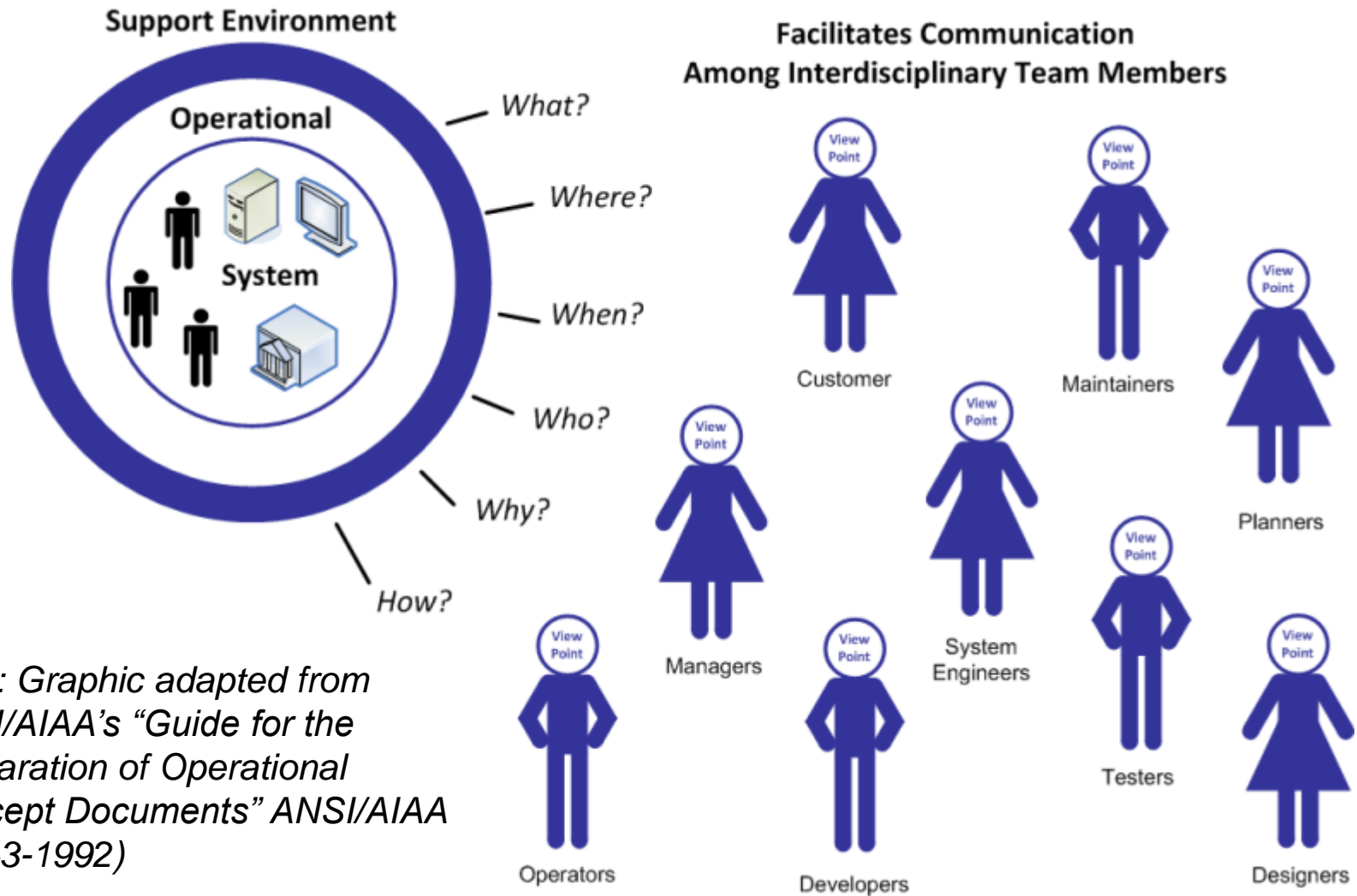
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- Provides an operational description of “how” the Operational Scenarios may operate
- Builds consensus among AERIS user groups and stakeholders concerning needs and expectations of:
  - USDOT
  - State and Local Departments of Transportation (DOTs)
  - Regional Planning Organizations
  - The Automotive Industry
  - ITS Developers, Integrators, and Researchers
- Serves as a guideline moving forward with research and development of AERIS applications

**AERIS Concepts of Operations are intended to be a blueprint describing the Operational Scenarios so all stakeholders can understand how they may work**



# Conceptual Representation of a ConOps



*Note: Graphic adapted from ANSI/AIAA's "Guide for the Preparation of Operational Concept Documents" ANSI/AIAA G-043-1992)*



# AERIS Concept of Operations

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- AERIS Concept of Operations documents are intended to convey “transformational ideas” that will be modeled to show the potential environmental benefits that can be achieved through connected vehicle applications
  
- AERIS Concept of Operations are “generalized” and not specific to:
  - Geographic area
  - Operating entity (e.g., state or local DOT)
  - Existing systems that may be in place
  - Operating procedures
  - Political environment





# Defining the System

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## LOW EMISSIONS ZONE SYSTEM

### Low Emissions Zone System

- Most likely resides in a Traffic Management Center
- Developed by state and local DOTs and ITS developers
- Integrated with existing ITS systems (i.e., ATMS operating platforms)
- Collects V2I messages (e.g., probe messages and environmental messages)
- Processes connected vehicle and 'conventional' data
- Disseminates traveler information messages (e.g., parameters for the low emissions zone)
- Collects fees or provides incentives

## IN-VEHICLE SYSTEM

### In-Vehicle System

- Resides in the vehicle
- Developed by automobile OEMs or aftermarket device vendors.
- Collects vehicle diagnostics data, V2V, and V2I messages
- Provides V2I messages to Connected Vehicle Roadway Equipment
- Implements eco-driving strategies (e.g. CACC, vehicle platooning, etc.)
- Facilitates fee payments and collection of incentives

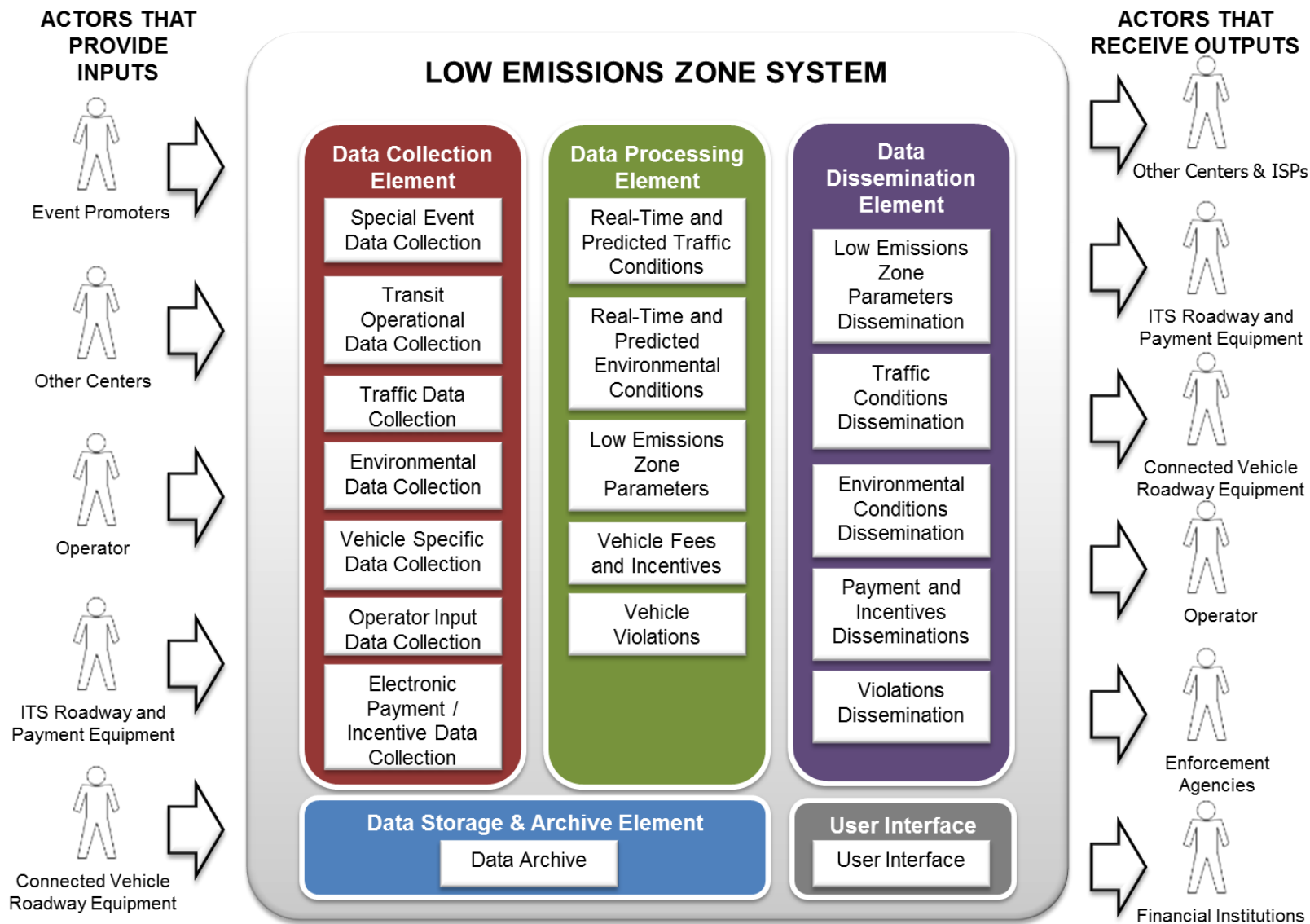


# Low Emissions Zone System

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- The Low Emissions Zone System is a computerized transportation system that:
  - Gathers traffic and environmental information from multiple sources.
  - Processes these data and determines whether a low emissions zone should be created or decommissioned for an area, along a corridor, or for a region.
  - Determines parameters for the zone including the location and duration of the zone, criteria for vehicles entering the zone, and fee / incentive structures.
  - Supports the collection of fees and/or incentives. Travelers may:
    - Pay a fee for entering the low emissions zone, preferably using connected vehicle electronic toll collection technology. Fees may be based on criteria such as the type of vehicle, engine type, and emissions profile of the vehicle.
    - Receive an incentive (e.g., partial or full fee rebate, credit that can be applied to future low emission zone fees or transit fares) when entering or leaving the zone for green transportation choices. Incentives may be determined based on:
      - Transit usage
      - Amount of time the vehicle spent in the low emissions zone
      - Mileage driven within the zone
      - Amount of emissions emitted while in the zone
  - Provides traveler information and shares information about the low emissions zone with regional jurisdictions to support coordinated operations.





# LOW EMISSIONS ZONE SYSTEM

## Data Collection Element

1. LEZS-DC-01: Collect Special Event Data
2. LEZS-DC-02: Collect Transit Operations Data
3. LEZS-DC-03: Collect Traffic Data
4. LEZS-DC-04: Collect Environmental Data
5. LEZS-DC-05: Collect Operator Input
6. LEZS-DC-06: Collect Vehicle Specific Data
7. LEZS-DC-07: Collect Electronic Payments

## Data Processing Element

1. LEZS-DP-01: Process Traffic Data
2. LEZS-DP-02: Generate Predicted Traffic Conditions and Forecast Demand
3. LEZS-DP-03: Process Environmental Data
4. LEZS-DP-04: Generate Predicted Emissions Profile
5. LEZS-DP-05: Create and Decommission Low Emissions Zones
6. LEZS-DP-06: Determine Fees for Vehicles
7. LEZS-DP-07: Determine Incentives for Individual Vehicles
8. LEZS-DP-08: Detect Violations for Individual Vehicles
9. LEZS-DP-09: Manage Electronic Payment Processing

## Data Dissemination Element

1. LEZS-D-01: Disseminate Low Emissions Zone Parameters to Vehicles
2. LEZS-D-02: Disseminate Low Emissions Zone Parameters to Centers & Travelers
3. LEZS-D-03: Disseminate Traffic Conditions to Other Centers and Travelers
4. LEZS-D-04: Disseminate Traffic Conditions to Vehicles
5. LEZS-D-05: Disseminate Multi-Modal Travel Options
6. LEZS-D-06: Disseminate Environmental Conditions to Other Centers & Travelers
7. LEZS-D-07: Disseminate Environmental Conditions to Vehicles
8. LEZS-D-08: Disseminate Information for Request for Electronic Payment to Individual Vehicles
9. LEZS-D-09: Request Payment from Financial Institutions
10. LEZS-D-10: Provide Incentives
11. LEZS-D-11: Provide Confirmation of Payment or Incentive to Vehicles
12. LEZS-D-12: Provide Notice of Violation to Vehicles
13. LEZS-D-13: Notify Enforcement Agencies of Violations

## Data Storage and Archive Element

1. LEZ-DA-01: Archive Low Emissions Zone Data
2. LEZ-DA-02: Archive Financial Data
3. LEZ-DA-02: Determine Performance Measures

## User Interface Element

1. LEZ-UI-01: User Interface



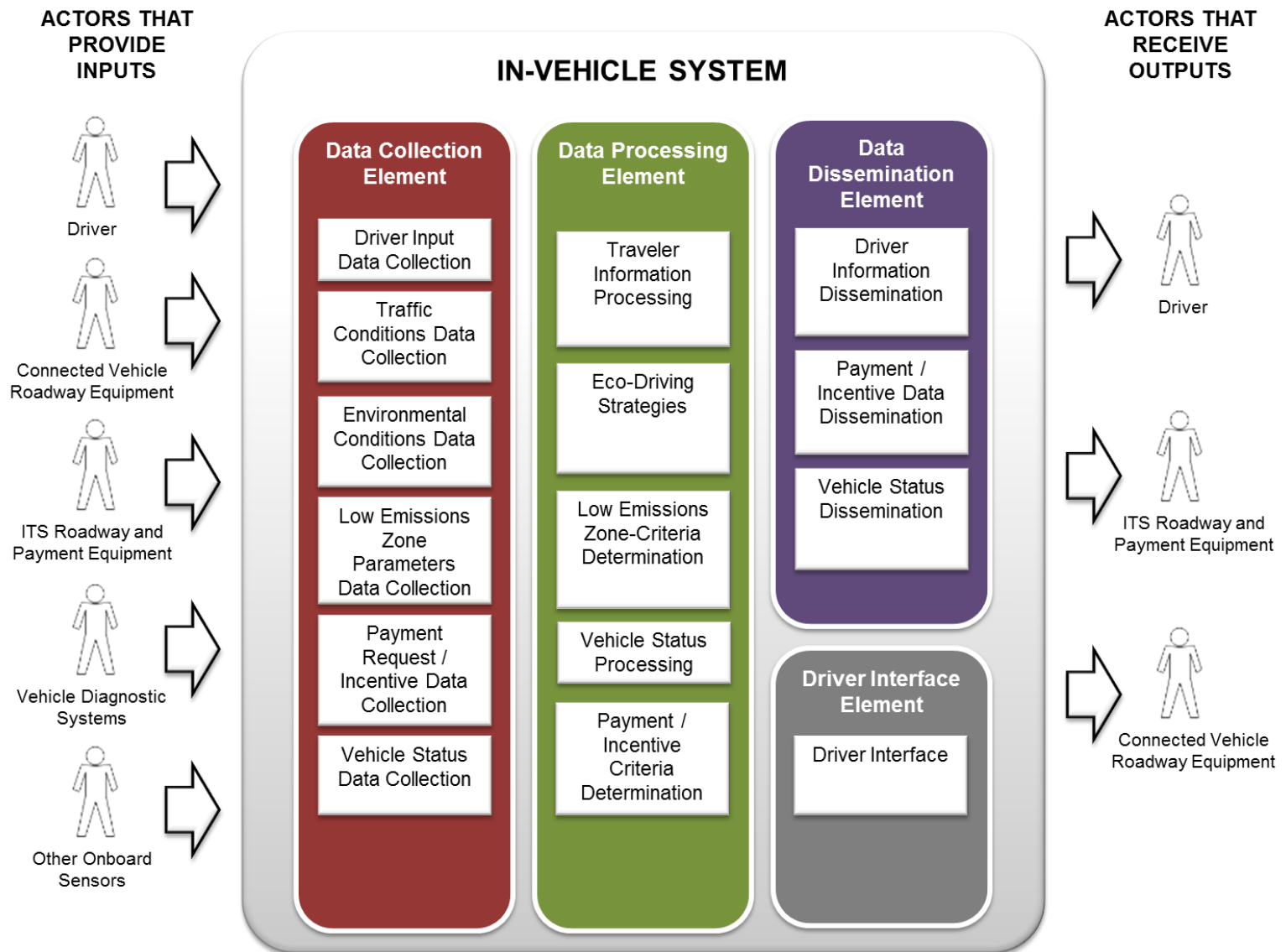
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# In-Vehicle System

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- The In-Vehicle System:
  - Collects information about the Low Emissions Zone, as well as traffic and environmental conditions, and presents this information to the driver to assist him or her in making informed pre-trip and en-route travel choices.
  - Collects emissions data from vehicle diagnostic systems or other on-board sensor to disseminate these data to Connected Vehicle Roadway Equipment. These data would be used by the Low Emissions Zone System – located at a center – to determine when a Low Emissions Zone should be established or decommissioned based on real-time environmental conditions data. These data would also be used to help determine the fee / incentive structure for the low emissions zone.
  - Collects data to help determine fees / incentives, including:
    - Vehicle type
    - Time or mileage driven within the low emissions zone
    - Emissions emitted while the vehicle is in the low emissions zone
  - Supports payment of fees or collection of incentives using connected vehicle (and other) technologies.
  - Supports eco-driving applications.





## IN-VEHICLE SYSTEM

### Data Collection Element

1. IVS-DC-01: Collect Driver Input
2. IVS-DC-02: Receive Traffic Conditions Data
3. IVS-DC-03: Receive Environmental Conditions Data
4. IVS-DC-04: Receive Low Emissions Zone Parameter Data
5. IVS-DC-05: Receive Payment / Incentive Request Information
6. IVS-DC-06: Receive Confirmation of Payment or Incentive
7. IVS-DC-07: Receive Notice of Violation
8. IVS-DC-08: Collect Vehicle Diagnostics Data

### Data Processing Element

1. IVS-DP-01: Process Traffic and Environmental Data for Traveler Information Messages
2. IVS-DP-02: Determine Trip/Route Options
3. IVS-DP-03: Determine Eco-Driving Recommendations
4. IVS-DP-04: Determine the Vehicle's Criteria for Entering the Low Emissions Zone
5. IVS-DP-05: Determine Vehicle Emissions Data
6. IVS-DP-06: Manage Fee or Incentive Payment

### Data Dissemination Element

1. IVS-D-01: Provide Traffic Conditions to the Driver
2. IVS-D-02: Provide Environmental Conditions to the Driver
3. IVS-D-03: Provide Low Emissions Zone Parameters to the Driver
4. IVS-D-04: Provide Trip/Route Information to the Driver
5. IVS-D-05: Provide Eco-Driving Information to the Driver
6. IVS-D-06: Disseminate Payment/Incentive Data
7. IVS-D-07: Disseminate Vehicle Status Data
8. IVS-D-08: Disseminate Vehicle Status Environmental Data

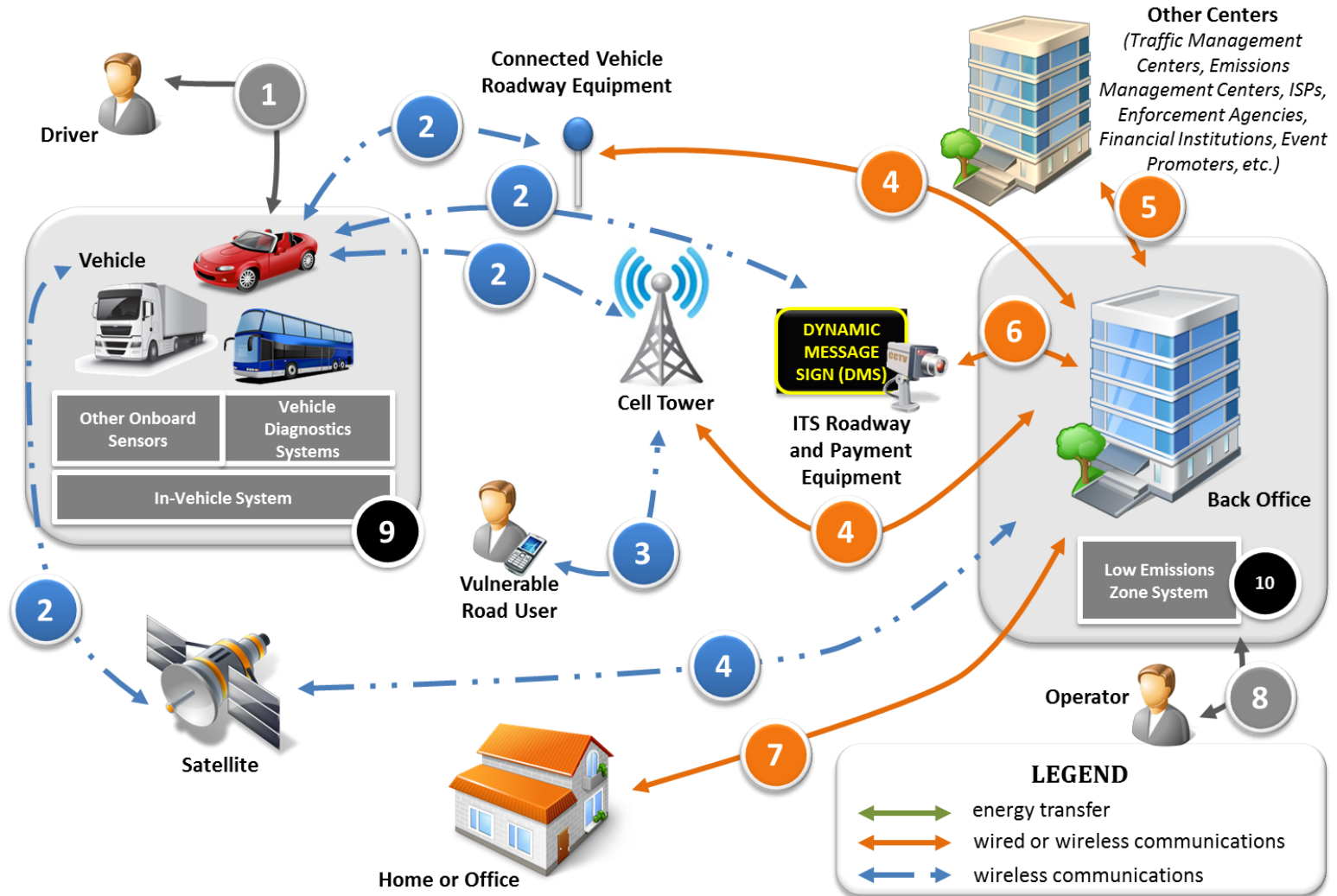
### Driver Interface Element

1. IVS-DI-01: Provide Driver Interface



Vehicle

# Low Emissions Zones





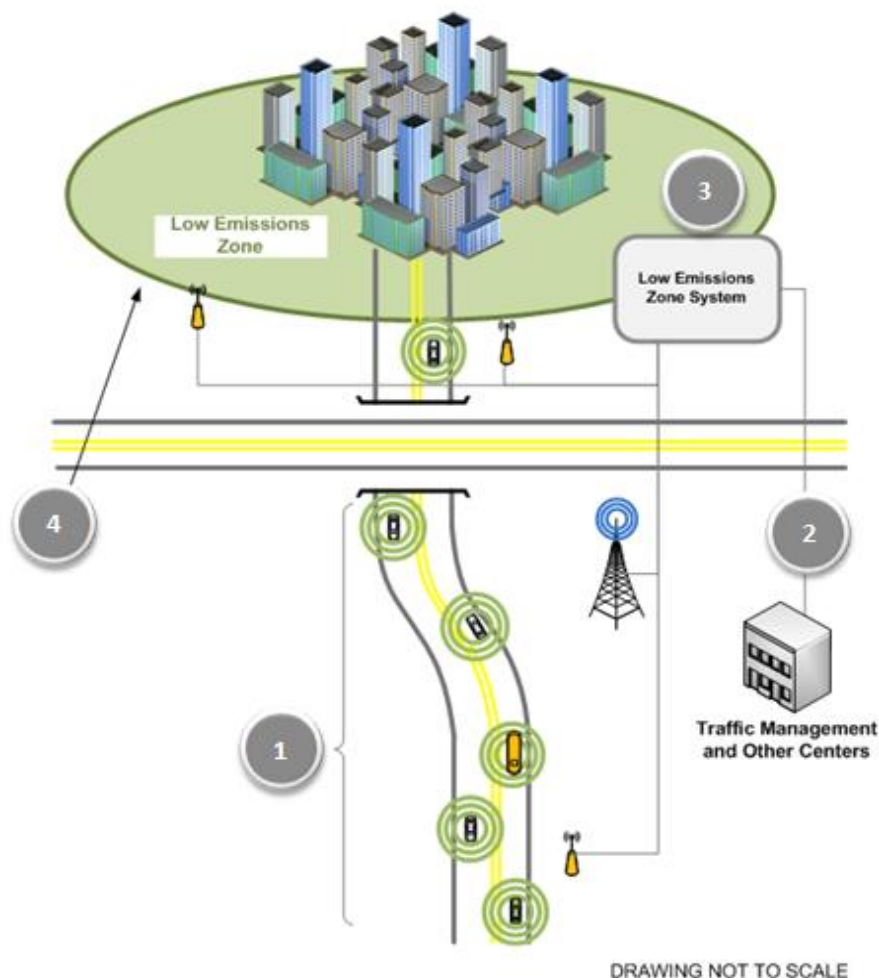
# Low Emissions Zones

Table 8-1: Low Emissions Zones Interfaces and Data Exchanges

Item	Actors	Data Exchange / Action	Related User Needs
1	In-Vehicle System and Driver	<p><u>In-Vehicle System sends to Driver</u></p> <ul style="list-style-type: none"> <li>Low Emissions Zone parameters (e.g., location, duration, fee structure, and other characteristics)</li> <li>Eco-driving recommendations (e.g., recommended driving speeds, driver feedback, etc.)</li> <li>Multi-modal options</li> <li>Traffic conditions</li> <li>Environmental conditions (e.g., code red air quality alerts)</li> <li>Road weather conditions</li> <li>Incentive received (or fee paid)</li> <li>Financial information</li> <li>Notice of violation</li> </ul> <p><u>Driver Sends to In-Vehicle System</u></p> <ul style="list-style-type: none"> <li>Activation of Application (e.g., activate eco-driving application, activate incentive application)</li> <li>Updates to configurable parameters for Low Emissions Zone access, fees, and/or incentives</li> <li>Origin-Destination (O-D) information</li> </ul>	<ul style="list-style-type: none"> <li>IVS-DC-01: Collect Driver Input</li> <li>IVS-D-01: Provide Traffic Conditions to the Driver</li> <li>IVS-D-02: Provide Environmental Conditions to the Driver</li> <li>IVS-D-03: Provide Low Emissions Zone Parameters to the Driver</li> <li>IVS-D-04: Provide Trip/Route Information to the Driver</li> <li>IVS-D-05: Provide Eco-Driving information to the Driver</li> <li>IVS-DI-01: Provide Driver Interface</li> </ul>

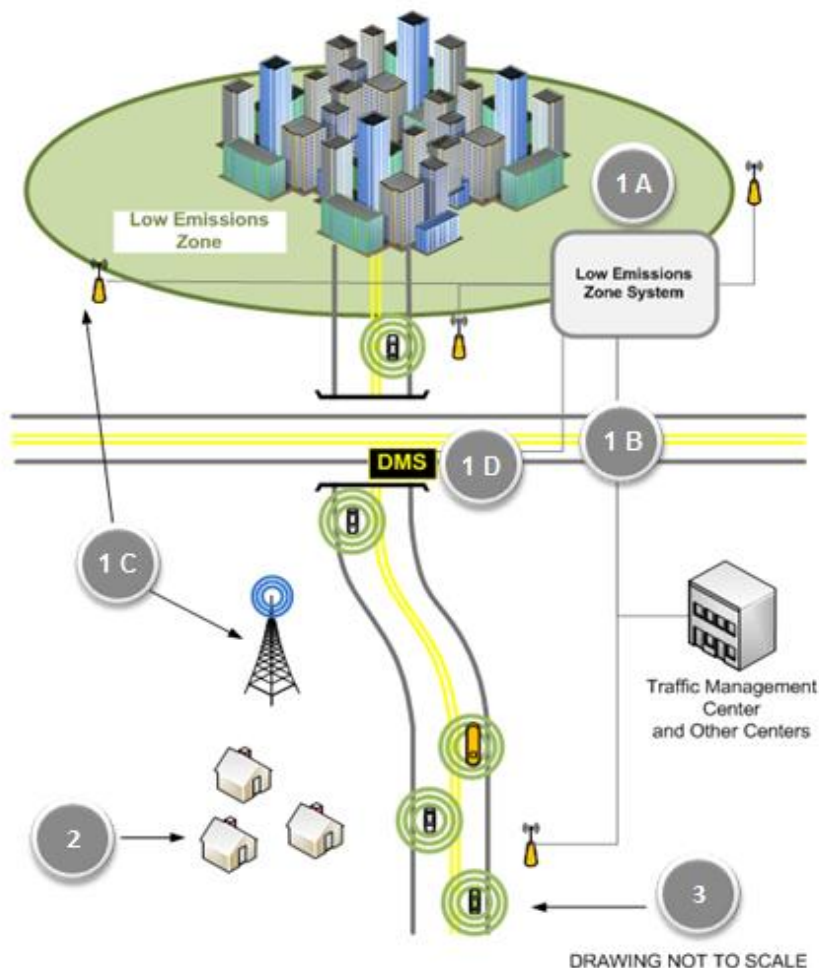


# Establishing a Low Emissions Zone



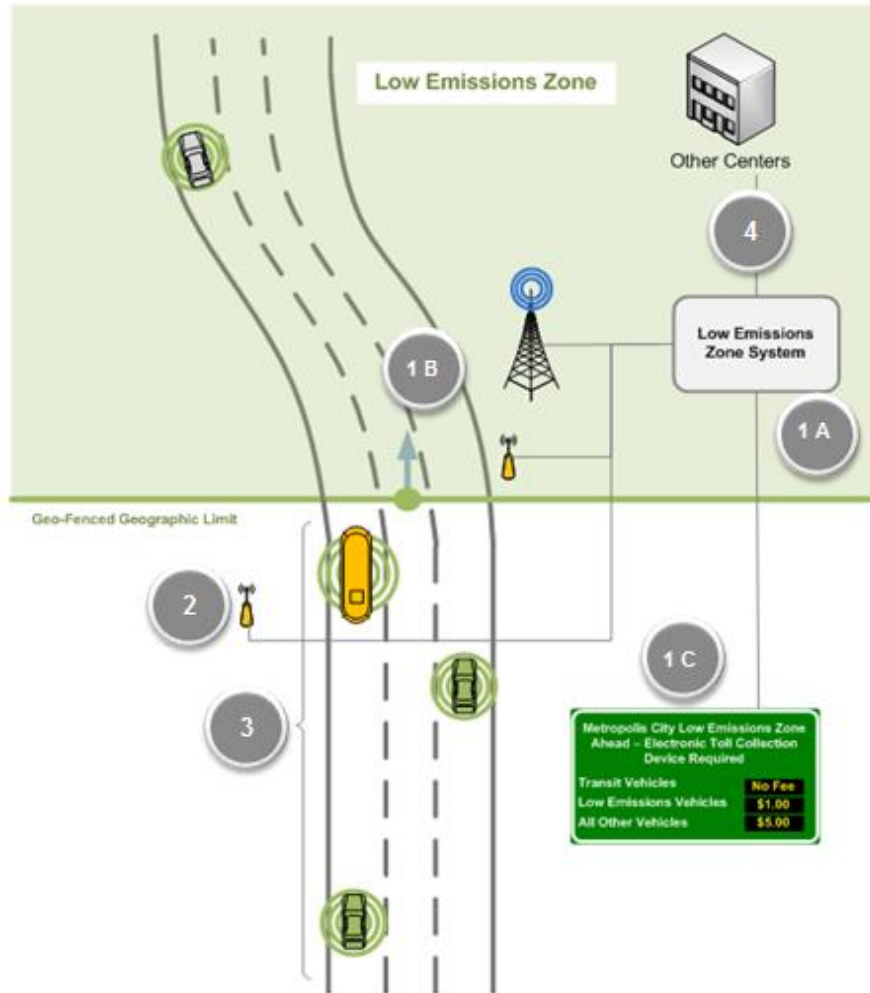
Step	Description
1	<b>In-Vehicle Systems</b> collect data from vehicle diagnostic systems and other onboard systems about the vehicle's emissions and vehicle's status (e.g., current speed, acceleration, location, etc.). These data are sent to <b>Connected Vehicle Roadway Equipment using DSRC, or other wireless communications</b> . Vehicle emissions data may be collected directly from vehicle diagnostic systems or estimated from other data collected from the vehicle. Estimates for emissions may be based on the vehicle's speed, acceleration, and engine characteristics. If emissions data cannot be collected or estimated on the vehicle, vehicle status data (e.g., speed, acceleration, engine type, etc.) may be sent to a Connected Vehicle Roadway Equipment and then to the Low Emissions Zone System which would estimate vehicle emissions at a center.
2	<b>Other Centers/systems</b> provide traffic, environmental, special event, and transit data to the <b>Low Emissions Zone System</b> . These data are sent from center to center. Traffic data includes volumes, speeds, occupancy, travel times, incidents, or other traffic data collected by a <b>Traffic Management Center</b> . These data may be collected using ITS Roadway Equipment such as traffic sensors, probe vehicles, or other ITS technologies. Environmental data includes air quality data or weather data collected by Emissions Management Centers. Finally, transit data includes information about transit routes, transit schedules, and other transit related information from the Transit Management Center.
3	The <b>Low Emissions Zone System</b> uses the data collected from <b>Connected Vehicle Roadway Equipment, ITS Roadway Equipment, and Other Centers</b> as well as historical data to determine whether a <b>Low Emissions Zone</b> should be established, and if so, the parameters of the <b>Low Emissions Zone</b> . These parameters include the geographic limits of the Low Emissions Zone, duration of the zone, and fee structure parameters.
4	The <b>Low Emissions Zone</b> is established by the <b>Low Emissions Zone System</b> and is approved by the operator. The <b>Low Emissions Zone System</b> geo-fences the geographic limits of the zone and assigns parameters including the fee structure for the zone. Once the zone is established, traffic and environmental data continue to be collected and monitored by the Low Emissions Zone operators to track the performance of the Low Emissions Zone.

# Low Emissions Zone Traveler Information



Step	Description
1	<p><b>Step 1 A:</b> The Low Emissions Zone System determines the parameters for the Low Emissions Zone.</p> <p><b>Step 1 B:</b> The Low Emissions Zone sends parameters about the Low Emissions Zone to Other Centers such as Traffic Management Centers and Transit Management Centers. These centers use information about the Low Emissions Zone to support traffic and transit operations in the vicinity of the Low Emissions Zone. Information is also sent to Information Service Providers, including the media, allowing them to disseminate information to travelers via television, radio, websites, or other sources.</p> <p><b>Step 1 C:</b> Connected Vehicle Roadside Equipment broadcast messages about the parameters of the Low Emissions Zone. Messages may be broadcast using DSRC communications or other wireless communications. This includes information such as the geographic limits of the Low Emissions Zone, the time the zone will be established and decommissioned, and the fee structure for entering the zone.</p> <p><b>Step 1 D:</b> ITS Roadway Equipment including Dynamic Message Signs provide information about the parameters of the Low Emissions Zone.</p>
2	<p>Travelers receive pre-trip traveler information about the parameters of the Low Emissions Zone and other traveler information. This information may be received by travelers from the Low Emissions Zone operating agency or other Information Service Provider on their personal computers, cell phones, tablets, television, radio, or 511 traveler information systems. Travelers use this information to plan their trips accordingly. For example, upon receiving information about the Low Emissions Zone, travelers may decide to switch their mode to transit or change their departure time to avoid entering the zone while it is commissioned.</p>
3	<p>In-Vehicle Systems receive information about the parameters of the Low Emissions Zone. This information is presented to drivers to assist them in making informed en-route travel choices as they approach the Low Emissions Zone. Upon receiving this information, drivers may decide to change their route to avoid the Low Emissions Zone or decide to switch their travel mode to transit.</p>

# Low Emissions Zone Fee Collection

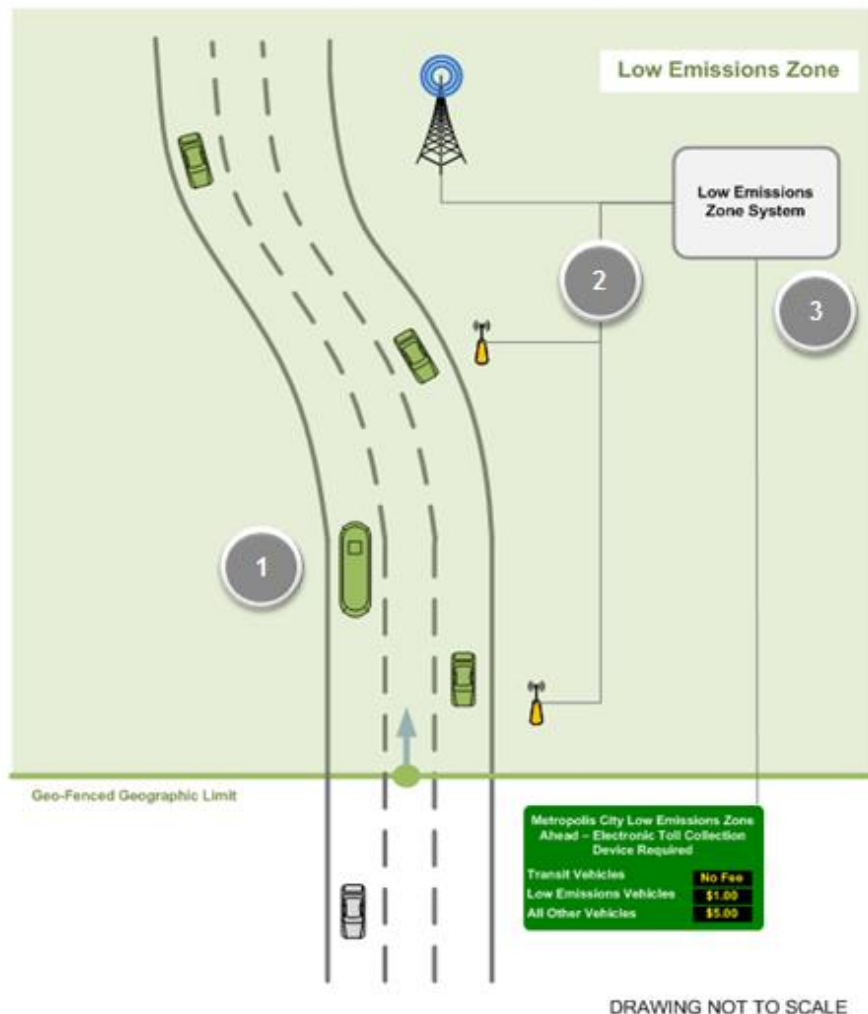


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Step	Description
1	<p><b>Step 1 A:</b> The Low Emissions Zone System determines the parameters for the Low Emissions Zone.</p> <p><b>Step 1 B:</b> Connected Vehicle Roadside Equipment broadcast messages about the parameters of the Low Emissions Zone. Messages may be broadcast using DSRC communications or other wireless communications. This includes information such as the geographic limits of the Low Emissions Zone, time the zone will be established and decommissioned, and fee structure for entering the zone. This information is received by In-Vehicle Systems.</p> <p><b>Step 1 C:</b> ITS Roadway Equipment provide information to travelers about the geographic limits of the Low Emissions, time the zone will be commissioned and decommissioned, and fee structure for entering the zone.</p>
2	<p><b>Connected Vehicle Roadway Equipment provide information about the fee structure to In-Vehicle Systems as vehicles approach the Low Emissions Zone boundary.</b> Drivers are informed that there is a \$5.00 fee to enter the Low Emissions Zone; however vehicles meeting the low emissions criteria may enter at a reduced fee of \$1.00. Transit Vehicles may enter the Low Emissions Zone at no cost. Connected Vehicle Roadway Equipment also send request for payment messages to in-vehicle systems. <b>These messages request that vehicles provide information about the vehicle's engine type, average emissions, or other vehicle specific data to determine the fee for individual vehicles.</b></p>
3	<p><b>In-Vehicle Systems send data about the vehicle's engine type, average emissions, a unique identification number, and payment information via secure communications to Connected Vehicle Roadway Equipment and then to the Low Emissions Zone System.</b> Upon receiving this information, the Low Emissions Zone System compares these data to the parameters established for the zone and determines the fee for the vehicle.</p>
4	<p><b>The Low Emissions Zone System requests payment from the financial institution. The financial institution transfers funds to the entity operating the Low Emissions Zone.</b></p>

# Low Emissions Zone

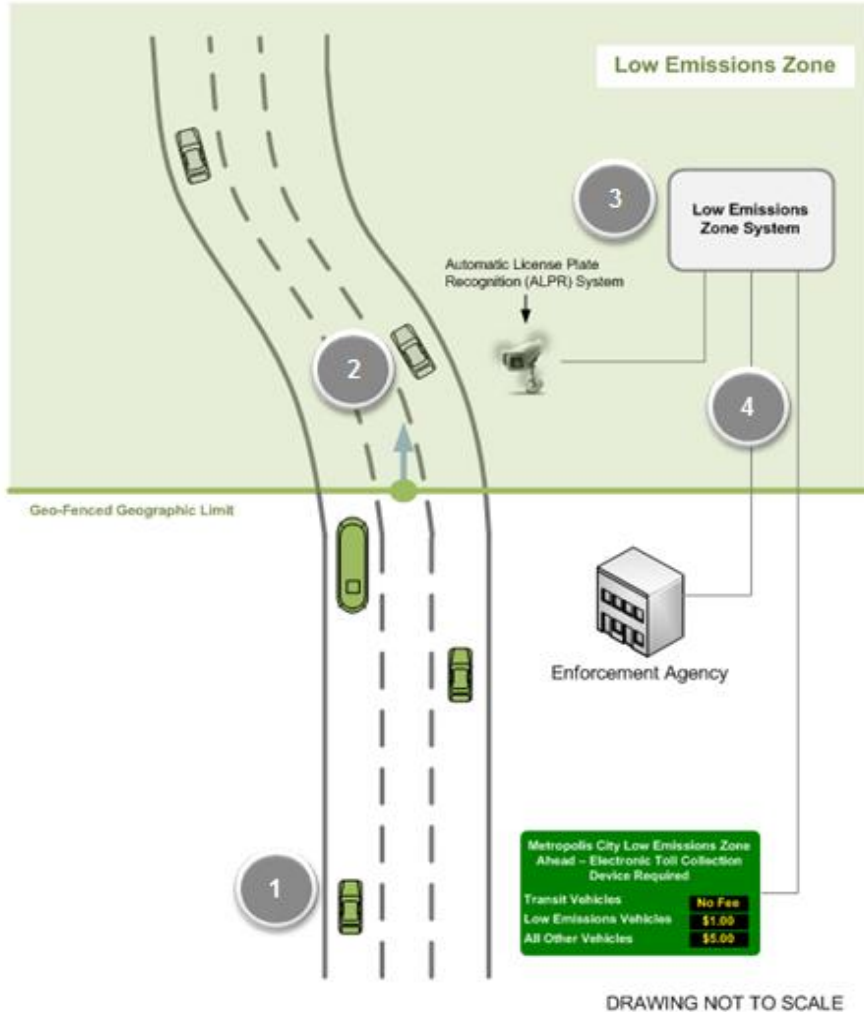
## Incentives Upon Leaving the Zone



Step	Description
1	<p>In-Vehicle Systems collect data that may be used for receiving incentives or rebates upon leaving the Low Emissions Zone. This may include information about:</p> <ul style="list-style-type: none"> <li><b>The amount of time spent within the Low Emissions Zone</b> – This would require the Low Emissions Zone System to record the time the vehicle entered and exited the Low Emissions Zone. The Low Emissions Zone System would calculate the time the vehicle was in the Low Emissions Zone and if it was less than a pre-determined threshold, the driver of the vehicle would be eligible for an incentive or rebate.</li> <li><b>Number of miles driven within the Low Emissions Zone</b> – This would require the In-Vehicle System to record the number of miles driven within the Low Emissions Zone System and provide this information to the Low Emissions Zone System. If the vehicle traveled less miles in the zone than a pre-determined threshold, the driver of the vehicle would be eligible for an incentive or rebate.</li> <li><b>Amount of emissions emitted while in the Low Emissions Zone</b> – This would require the In-Vehicle System to record the number of miles driven within the Low Emissions Zone System and provide this information to the Low Emissions Zone System. If the vehicle emitted fewer emissions in the zone than a pre-determined threshold, the driver of the vehicle would be eligible for an incentive or rebate.</li> </ul>
2	<p><b>Connected Vehicle Roadway Equipment disseminates a message to In-Vehicle Systems requesting them to provide data for incentives or rebates.</b></p>
3	<p><b>In-Vehicle Systems provide data for incentives or rebates to the Low Emissions Zone System through Connected Vehicle Roadway Equipment. This information would be sent using secure communications to ensure privacy. Upon receiving these data, the Low Emissions Zone determines if an individual vehicle should be given an incentive. If it is determined that the vehicle should receive an incentive, the system provides the incentive to the account of the vehicle. The Low Emissions Zone System archives all data related to the incentive request and financial transaction.</b></p>



# Low Emissions Zone Violations



Step	Description
1	The Low Emissions Zone requires electronic payment of fees using either Connected Vehicle technologies or a toll tag transponder. <b>A vehicle not equipped with Connected Vehicle technologies, or other means for paying a toll electronically, approaches the Low Emissions Zone. Static Signs and messages on DMS prior to the limits of the Low Emissions Zone inform the driver about the upcoming zone and requirement for in-vehicle electronic payment systems or transponders. Signage also informs motorists of alternative routes around the Low Emissions Zone to avoid entering the zone in violation of the zone's parameters.</b>
2	The driver decides to enter the Low Emissions Zone. Since <b>the vehicle is not equipped with an in-vehicle electronic payment systems or transponder, it is in violation.</b>
3	<b>At the entrance on the Low Emissions Zone, an ALPR system takes a picture of every vehicle's license plate.</b> This information is compared to messages collected from vehicles using connected vehicle technologies as they enter the zone and pay their fees. <b>The Low Emissions Zone System cannot match the vehicle's information to the payment of a fee and determines it is in violation.</b>
4	<b>Once the Low Emissions Zone System determines that a vehicle is a violator, data about the violation and the vehicle (e.g., the vehicle's license plate number) are sent to an Enforcement Agency which issues a citation to the owner of the vehicle.</b> This citation could be given to the vehicle owner by mail, requesting payment for entering the zone.



# Policy Considerations

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- Would certain vehicle types be allowed to enter the low emissions zone at a higher priority than other vehicle types?
- Are there mobility tradeoffs? If so, how do operating entities make a decision to optimize for the environment instead of optimizing for mobility?
- How can this Operational Scenario facilitate “green” choices by:
  - Drivers,
  - State and local DOT’s operating the transportation system, and
  - Decision Makers?
- How can this Operational Scenario incentivize “green” choices by:
  - Drivers,
  - State and local DOT’s operating the transportation system, and
  - Decision Makers?
- How does open data sharing and standardization be used to support public and private sector deployment?
- Under what situation(s) would an operating entity choose to implement a low emissions zone?
- How do Decision Makers value eco-lanes as an option for investing scarce resources?



# Educational Considerations

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- What are the social benefits of “green” transportation decisions?
  - Drivers
  - State and local DOT’s operating the transportation system
- What types of educational campaigns could be used to educate the traveling public to make green transportation choices?
- What types of educational campaigns could be used to educate entities operating the transportation network to optimize for the environment?
- How do you incentivize a choice versus another choice? And how do you get people to act on that choice?

**Provide travelers and entities operating the transportation network the information they need to make “green” transportation choices**





# Sources

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1. Transport for London. (2011). The Low Emission Zone. Retrieved September 2, 2011, from <http://www.tfl.gov.uk/assets/downloads/roadusers/lez/LEZ/lez-leaflet-jan-2012.pdf>

